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AUTHOR Crowley, Anne E.; And Others
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ABSTRACT

Because the demand for health services exceeds the supply, information concerning the aspirations, interests, and motivating factors which lead individuals to choose a health career and the obstacles in the path of health career development are of vital concern to counselors and guidance personnel. This paper reports the findings of three studies which utilized data from the Project Talent Data Bank to identify similarities and differences in personal traits of dentists, pharmacists, and physicians. Specifically, the focus of the dentistry study was on the process of career development with attention to the stability of career choice, while the pharmacy study was concerned with time of career choice. The physician study considered the modifying effect that family-community environment and high school have upon final career choice. Findings, presented separately for each study, suggest certain considerations for career counselors and for admissions personnel. The first is the individual's self assessment and perceptions of occupations open to him. The second is the selection of applicants by professional schools. (JS)

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A LONGITUDINAL STUDY OF THE CAREER DEVELOPMENT OF HEALTH PROFESSIONALS

Anne E. Crowley
Division of Medical Education
American Medical Association

Frank T. Schimpfhauser, Ph. D.
Department of Psychology
Ohio Dominican College

Joseph K. Wittemann, Ph. D.
Department of Psychology
Ohio Dominican College

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Introduction. For the past few years there has been a growing public awareness of the need to improve health care in the United States. Satisfactory delivery of health services is a complex problem of which the number of health professionals available is only one aspect. Distribution, geographically and by specialty practice, is an important factor in answering the need for services. If, as in a totalitarian state, health professionals were geographically rearranged so they were more evenly distributed throughout the population, the delivery of health services would be strikingly improved and the public perception of a shortage of health manpower would be considerably less.

The severely inadequate health care provided to the poor in slum areas and the sparsity of health facilities and manpower in rural areas are problems frequently cited with the implication that they would be corrected by an increase in the number of health professionals. Of course, to simply increase the number of trained persons would not necessarily result in an increased number serving in ghettos and rural areas.

It is generally agreed, however, that the demand for health services exceeds the supply of manpower to provide the services. One response to the problem is to increase enrollment in schools which train health care specialists, such as medical, dental, and pharmacy schools. To proceed intelligently toward the goal of providing a greater number of health

professionals who will serve the needs of society, we must know about the aspirations, interests, and motivating factors which lead individuals to choose a health career; and, on the other hand, we must identify the obstacles in the path of health career development.

Three national organizations of health professionals have provided financial support for studies of the characteristics of potential members of their professions. The American Medical Association through its Division of Medical Education has made possible a study of the characteristics of medical school applicants. The Dental Health Center Educational Research Program of the U. S. Public Health Service, in cooperation with the American Dental Association, has supported a study of the career development of dental school applicants. The American Association of Colleges of Pharmacy has supported a study tracing the development of careers in pharmacy.

Purpose. The overall purpose of the Career Development Study has been to identify similarities and differences in regard to personal traits among three health professions. Each of the three sub-studies has a specific thrust. The particular focus of the dentistry study was on the process of career development with attention to the stability of career choice. The pharmacy study was concerned with time of career choice, comparing early choosers with late choosers. The physician study considered the modifying effect that family-community environment and high school have upon final career choice.

Sample. Each of the three studies obtained data from the Project Talent Data Bank. From the population of applicants to medical school for the years 1964-1968, the AMA study identified medical school applicants

who were tested in high school by Project TALENT. The study of dental school applicants obtained its sample in a similar manner.

The pharmacy study began with registered pharmacists in the age cohort most likely to have been in high school in 1960 when the Project TALENT data was collected. From this cohort a sample tested by Project TALENT was identified.

Three criteria were defined for grouping the individual samples. The first of these was career aspiration in high school, based on the student's response to a Project TALENT question. Did the individual choose medicine (dentistry/pharmacy) or another career? The second criterion was the subsequent action taken by the student to actualize this expressed career aspiration. Did he apply to a professional school? The third criterion was the success of his action. Was he enrolled in a professional school? (For the pharmacy study, the data for the second criterion were not available. Therefore, pharmacy applicants who were not enrolled or who did not graduate are omitted from the study.)

On the basis of these criteria, groups unique to each study were identified. The study of medical school applicants has five groups:

CAE: those who chose medicine in high school, applied to and entered medical school.

$CA\bar{E}$: those who chose medicine in high school, applied to but did not enter medical school.

$C\bar{A}\bar{E}$: those who chose medicine in high school, but neither applied to nor entered medical school.

$\bar{C}AE$: those who chose another career in high school, but applied to and entered medical school.

$\bar{C}A\bar{E}$: those who chose another career in high school, applied to but did not enter medical school.

The study of dental school applicants has eight groups:

OAE: those who aspired to denistry, applied to and entered dental school.

$OA\bar{E}$: those who aspired to dentistry, applied to, but did not enter dental school.

$O\bar{A}$: those who aspired to dentistry, but did not apply to dental school.

OHAE: those who aspired to another health career, applied to and entered dental school.

$OHA\bar{E}$: those whc aspired to another health career, applied to but did not enter dental school.

$\bar{O}AE$: those who aspired to a non-health career, but applied to and entered dental school.

$\bar{O}A\bar{E}$: those who aspired to a non-health career, applied to but did not enter dental school.

$\bar{O}\bar{A}E$: a control group; those who aspired to a non-health career, did not apply to nor enter dental school.

The study of pharmacists has nine groups:

OPEP: those who aspired to and entered pharmacy.

OHEP: those who aspired to another health career, but entered pharmacy.

ONEP: those who aspired to a non-health career, but entered pharmacy.

OPEH: those who aspired to pharmacy, but entered another health career.

OHEH: those who aspired to another health career and entered a health career.

ONEH: those who aspired to a non-health career, but entered a health career (not pharmacy).

OPEN: those who aspired to pharmacy, but entered a non-health career.

OHEN: those who aspired to another health career, but entered a non-health career.

ONEN: a control group; those who aspired to and entered a non-health career.

The control groups in the dentistry and pharmacy studies are high ability samples from Project TALENT.

Variables. The personal traits considered in the three studies are measured by thirty-five variables. Six variables are composite ability scores: I.Q., general academic, verbal, quantitative, technical, and scientific. Two scores measure achievement: course-related information and non-course-related information. Another seventeen variables are interest scales: physical science, biological science, public service, literary-linguistics, social service, artistic, musical, sports, hunting and fishing, business management, sales, computation, office work, mechanical-technical, skilled trades, farming, and labor. Ten variables are temperament scales: sociability, social sensitivity, impulsiveness, vigor, calmness, tidiness, culture, leadership, self-confidence, mature personality. The physician study included three occupational interest scales: health occupations, health-related occupations, and professional occupations interest. This study included four additional variables: aspirations scale, career choice scale, importance of income scale, and importance of people scale. The dentistry and pharmacy studies also included the Project TALENT index SEE, socio-economic environment of the individual's family. This variable was included in the physician study but with other family variables, therefore, it is not reported in this paper.

Methodology. The research strategy for handling these variables is a multivariate discriminant analysis. This is a procedure for studying the predictability of group memberships from a set of trait measurements. The trait measures are the antecedent variables (those collected by

Project TALENT in 1960 and listed above.) The group membership criteria (career aspiration, application and enrollment in professional school) form the dependent variable. The objective of this analysis is to determine what combination of test variables best predicts the dependent variable, a compound of the criteria for group membership.

The procedure for studying criterion groups in a multivariate measurement space begins with the collection of measurements for samples of the criterion populations. Assuming that the groups are representative, the next question is whether the sample groups are comparable. Using Hartley's F_{max} test of homogeneity, we ascertained the comparability of the groups with regard to dispersion within each group on the test variables. The next step was to test the equality of group means. To do this we used Wilk's Lambda and an approximate F. We then computed an F matrix to test equality of means among pairs of groups.

Having determined that the groups were representative, that they were comparable with regard to dispersion , and that the groups means for the original variables were unequal, we then derived discriminant functions for each group. These are functions of the original variables which maximize the separation of the groups. On the basis of these functions, a classification matrix can test their efficiency in distinguishing the groups. We predict a subject's group membership using his scores on the test variables. This prediction was compared with his actual membership. The resulting ratio of correct to incorrect predictions is one indication of the power of the combined significant variables to distinguish the groups.

In these studies, we held back every third case in each group to form a replication sample for that group. We have tested the efficiency of the

discriminant functions first, on the study sample, then, on the replication sample.

Next, we generated a set of linear compounds of all the significant variables. These compounds are referred to as canonical variables and serve to reduce the dimensionality of the test space. The proportion of total variance accounted for by each canonical variable was calculated. All of the variance among the groups will be accounted for by (G - 1) canonicals, i.e., one less than the number of groups. The first two canonical variables were evaluated at group means and plotted to give an optimal picture of the distinction of the groups.

The computer program used for these studies is a stepwise discriminant analysis.[1] The procedure is to calculate an F value for each variable. Then a stepwise multiple regression analysis is carried out. The first variable entered is the one with the highest F value, i.e., the one which accounts for the most variance among the groups. The next variable to be entered is the one which, when partialed on the previously entered variables, has the highest multiple correlation with the groups. The stepwise analysis continues until all variables are included. It should be noted that when the F value of a variable goes below the tolerance level, that variable is deleted from the analysis.

Although the three studies used the same methodology and somewhat the same variables of personal traits, each was done by a different

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[1]The computer analysis was done at Ohio State University using the BMD07M Stepwise Discriminant Analysis Program developed by Paul Sampson of the Health Sciences Computing Facility Staff, UCLA. The authors are grateful to Aaron Supowit of Ohio State University for the technical adaptation of the BMD07M program to these studies.

person who posed a slightly different question. For this reason, we have reported the findings in three sections: Part I, Dentistry; Part II, Pharmacy; Part III, Medicine.

FINDINGS

Part I. DENTISTRY.

Significant Variables. Through successive F tests, nineteen variables were found to be most significant in differentiating between the groups. Table 1 presents these variables in descending order of F value.

TABLE 1.

F Values of 19 Significant Variables

Biological Science Interest	35.821**
Physical Science Interest	7.755**
Office Work Interest	4.359**
IQ Composite	4.230**
Labor Interest	4.085**
General Info Part I	3.804**
Socioeconomic Index	3.539**
Sports Interest	3.172**
Quantitative Aptitude	3.069**
Sociability	2.881**
Impulsiveness	2.830**
Literary-linguistic Interest	2.789**
Scientific Aptitude	2.783**
Sales Interest	2.780**
Computation Interest	2.248**
Calmness	2.207*
Self-confidence	2.067*
Social Service	2.029*
Artistic Interest	1.893*

Where F(.05, 7, 1000), 2.02 *
F(.01, 7, 1000), 2.66 **

Comparability of Groups. Hartley's F max test of honogeneity of dispersions showed that the groups cannot be considered comparable.

Table 4 presents the standard deviations for each criterion group on the nineteen significant variables. The variables with single asterisks are those that are heterogeneous on the basis of this test.

It was believed that this was probably due to the large number of variables, the large numbers of groups and the unequal and large sample sizes used in the study.

Equality of performance. The approximate F computed from the Wilk's Lambda indicates that the eight groups cannot be considered equal:

The computed, $F = 5.05$ with

$d.f. = 252$ and 6077.39

where $F(.01, 200, \infty) = 1.25$

This is the critical test of discrimination.

Discriminant Function and Classification. Stepwise Discriminant Analysis computes new linear combinations of the test variables. One function is computed for each group. These functions are similar to regression polynomials and they can be utilized for predictive purposes.

In order to test the efficiency of the discriminant functions a cross-validation technique was employed. This process consists of the use of the obtained discriminant functions to classify subjects who are known to belong to one of the criterion groups. Furthermore, the subjects who were included in the computation of the functions are also classified.

Table 5 presents the classification of the original sample and Table 6 presents the classification of the cross-validation group. In both instances a significant chi square was achieved indicating the existence of strong association between actual and assigned group membership.

Classification probabilities were computed in order to demonstrate how they can help a subject to compare his similarity to each of the eight criterion groups. This is typically done to validate tests. In this study, the efficiency of classification, in terms of correct assignments was found to be 45 percent for the study sample and 37 percent for the cross-validation sample. The low index of efficiency may be due to the confusion operating between at least four groups; OAE, OHAE, $\bar{O}AE$, and $OA\bar{E}$. It may well be that these four groups are more similar than what was concluded through the approximate F reported earlier.

Identification of Canonical Functions. The final step in Stepwise Discriminant Analysis is the computation of nineteen canonical functions. These functions are mutually uncorrelated. They are of a type that constitute an ordered set, in which the first canonical is the single linear function that accounts for most of the variation between the groups and thereby best differentiates the groups. The first and the second canonical combined are the pair that provides maximum differentiation, and so forth. The canonicals are orthogonal and thereby can be used for plotting purposes (Van de Geer, 1971).

Table 2 presents the first and second canonical function. The coefficients (scaled vectors) of the variables represent the magnitude of variance that the original variable contributes to the formation of the canonical function. The first two variables account for a total of 84 percent of the total dispersion in the test space.

TABLE 2.

Coefficients of Canonical Functions I and II

Original Variable	I	II
General Information, I	.006	.007
Sociability	-.075	.031
Impulsiveness	-.025	-.127
Calmness	.039	.016
Self-confidence	.057	-.037
Physical Science	.043	-.049
Biological Science	-.062	.122
Literary-linguistic	.021	-.030
Social Service	-.017	-.130
Artistic	-.017	-.130
Sports	.014	.018
Sales	.001	.023
Vigor	.014	.010
Office Work	-.037	-.002
Labor	.037	-.025
Socioeconomic Index	-.024	.011
IQ	.009	-.003
Quantitative Aptitude	.002	.007
Scientific Aptitude	.002	-.001
Cumulative Proportion of Total Dispersion	.584	.839

All of the cases are evaluated on the canonical variables and centroid scores are computed for each group. Table 3 presents the computed canonical discriminant centroids for the eight groups.

TABLE 3.

Computed Canonical Discriminant Centroids for Eight Groups

Group	Canonical Variable	
	I	II
OAE	.237	.799
$OA\bar{E}$	-.149	.676
$O\bar{A}$	-1.539	-.583
$OHAE$	.164	.995
$OHA\bar{E}$	.441	-.199
$\bar{O}AE$	-.315	.676
$\bar{O}A\bar{E}$	-.021	-.306
$\bar{O}\bar{A}\bar{E}$	1.863	-.763

By using the canonical variables as a two coordinate system wherein function I becomes Axis I and function II becomes Axis II, the centroids can be plotted in two dimensional space. Figure 1 presents the two dimensional picture of the separation effected between the eight groups of the study sample.

The groups that are most widely separated on Axis I are $O\bar{A}$ from $\bar{O}A\bar{E}$. Axis II separates groups OAE, $OA\bar{E}$, $\bar{O}AE$, and OHAE from $O\bar{A}$, $\bar{O}A\bar{E}$, OHAE, and $\bar{O}AE$.

Four groups appear to occupy relatively similar location in the test space. This clustering may account for the low efficiency of classification. This finding necessitates a redefinition of stability in career processing. That is to say, the groups which, (1) aspired to a health related career, applied to dental school, and entered (OHAE), (2) did not aspire to dentistry applied and entered ($\bar{O}AE$), (3) aspired to dentistry, applied, but did not enter ($OA\bar{E}$) are very much like the "stable" dental group. By originally defining stability in such a rigid fashion may have inadvertantly skewed the efficiency of classification. A broader, career field definition should be made.

By computing deviation scores for all the groups on each canonical it was found that, biological science interest and course related general information contributed the greatest to the separation of the eight groups into two clusters.

Further evidence of group differences on the nineteen variables can be shown by identifying the highest and lowest scoring group for each variable. Table 7 presents the means for the eight groups and indicates groups that are high and low by each variable. An attempt to characterize the six groups in terms of the variables resulted in the following conclusions:

1) Those who opted a dental health career, applied to a dental school and entered a dental school, scored high on sociability.

2) Those who opted a dental career, applied to a dental school, but did not enter a dental school, scored high on self-confidence and lowest on the impulsiveness scales of the Student Activities Inventory. This group scored highest on sports interest, lowest on interest in literary-linguistics, social service, and computation. As was previously noted, group one and two are not significantly different on the basis of the F-test when comparing means of pairs of groups.

3) Those who opted a dental career, did not apply to a dental school, indicated lowest interest in physical sciences and sports, and highest interest in social service, sales, and office work. This group scored lowest on the I.Q. composite, the quantitative aptitude composite, and the scientific aptitude composite. O $\bar{A}$ also scored lowest on the socio-economic index.

4) Those who opted a health related career, applied to and entered a dental school, scored highest on the calmness scale of the S.A.I. and was most interested in the biological science ($\bar{X}$ = 30.303). It must be noted that this interest score has a maximum score of 40.000 indicating the maximum of like. Again, group 4 is not significantly different from group one on the basis of the F-value previously cited.

5) Those who opted a health related career, applied to a dental school, but did not enter, did not show any specific strength or weakness in performance on any of the test variables.

6) Those who did not opt for a dental career, applied to a dental school and entered, were least self-confident and preferred office work and labor as possible career interests. This group also scored highest on the socio-economic index.

7) Those who did not opt for a dental career, applied to a dental school, but did not enter, scored lowest on calmness and indicated most interest in computation.

8) Those who did not opt for, apply to, nor enter into dentistry but had high academic ability, scored highest on the impulsiveness scale of the S.A.I. They did not prefer the biological sciences and sales. This group indicated most interest in physical science, literary-linguistics, and labor. This group, as expected, performed best on the I. Q. composite, quantitative aptitude

composite, and scientific aptitude composite. Furthermore, it performed best with regard to general knowledge.

It seems that, on the basis of general knowledge, group $\bar{O}\ \bar{A}\ \bar{E}$ could choose from most any career field and be successful in it.

TABLE 4.

STANDARD DEVIATIONS FOR EACH CRITERION GROUP ON THE NINETEEN VARIABLES

Variable	O A E	O A $\bar{E}$	O $\bar{A}$	O_hA E	O_hA $\bar{E}$	$\bar{O}$ A E	$\bar{O}$ A $\bar{E}$	$\bar{O}$ $\bar{A}$ $\bar{E}$
*1 General Information, Part I	29.949	25.063	34.937[b]	24.466[a]	32.074	29.981	34.702	31.271
*3 Sociability	2.866	2.655	2.624[a]	2.752	2.962	2.964	3.059	3.180[b]
*5 Impulsiveness	1.345[a]	1.570	1.556	1.480	1.490	1.548	1.481	1.923[b]
*7 Calmness	2.459	2.579[a]	2.367	2.569	2.716	2.472	2.497	2.709[b]
*11 Self-confidence	2.729	2.468	2.233[a]	2.550	2.573	2.305	2.260	2.749[b]
*13 Physical science	6.892	7.059	9.108[b]	5.658[a]	7.838	6.929	9.022	7.999
*14 Biological science	6.606[a]	6.793	8.990	7.120	8.570	6.857	9.723[b]	8.980
*16 Literary-linguistic	7.457	7.167[a]	9.216	6.941	7.459	8.177	8.297[b]	8.937
*17 Social service	7.387	5.269[a]	8.511[b]	6.342	6.702	7.297	7.130	7.653
*18 Artistic	8.635	8.771	10.461[b]	7.996	7.441[a]	8.872	9.142	8.627
*20 Sports	6.942[a]	7.382	10.328[b]	7.328	8.507	9.061	8.799	8.041
*23 Sales	7.705	6.681[b]	9.231	7.392	7.745	7.576	9.275[b]	8.082
*24 Computation	7.706	7.487	7.946	6.986[a]	7.295	7.113	7.735	8.252[b]
*25 Office work	7.026	6.329[a]	10.077[b]	7.599	7.766	7.069	7.324	7.798
*29 Labor	5.959	5.686	7.484[b]	5.795	5.779	6.071	6.154	5.525[a]
*30 Socio-economic index	8.158	8.579	10.454[b]	8.585	9.076	8.937	9.507	8.238[a]
*31 I.Q. composit	32.948	33.954	58.430[b]	34.982	47.263	43.479	47.050	12.498[a]
*34 Quantitative compotit	37.690	38.851	37.446	40.885	43.443	44.098	44.507[b]	36.025[a]
*36 Scientific aptitude composit	115.931	124.166	153.535	115.148	148.846	153.502	162.284[b]	92.004

*Significant Hartley's F max test of homogeneity of variance by variable.
F max (.05, 8,∞) = 1.00
a) Group with smallest variability for the variable.
b) Group with largest variability for the variable.

TABLE 5.

CLASSIFICATION OF STUDENTS USED IN STUDY

Actual Group	Assigned Group 1	2	3	4	5	6	7	8*	Number of Hits Total	Observed	Expected
1 O A E	32 (19)	11 (10)	2 (17)	26 (11)	14 (10)	5 (11)	5 (13)	5 (15)	100	32	19
2 O A $\overline{E}$	7 (6)	24 (6)	4 (11)	4 (7)	6 (7)	10 (8)	8 (8)	1 (10)	64	24	6
3 O $\overline{A}$	3 (15)	16 (17)	113 (28)	4 (19)	5 (17)	9 (18)	14 (23)	2 (26)	166	113	28
4 O_hA E	13 (7)	9 (8)	3 (14)	28 (8)	6 (8)	12 (8)	4 (10)	1 (11)	76	28	8
5 O_hA $\overline{E}$	16 (15)	13 (17)	13 (28)	17 (19)	35 (17)	13 (18)	25 (23)	34 (26)	166	35	17
6 $\overline{O}$ A E	10 (8)	9 (9)	6 (14)	11 (10)	5 (9)	36 (10)	7 (12)	2 (13)	86	36	10
7 $\overline{O}$ A $\overline{E}$	7 (15)	15 (17)	18 (28)	13 (19)	20 (17)	15 (18)	63 (23)	15 (26)	166	63	23
8 $\overline{O}$ $\overline{A}$ $\overline{E}$	1 (19)	1 (10)	0 (17)	4 (11)	4 (10)	2 (11)	3 (13)	85 (15)	100	85	15
Total	89	98	159	107	95	102	129	145	924	416	126

Efficiency of Classification = (416 x 100)/924 = 45 percent
Expected Chance Efficiency = (126 x 100)/924 = 13 percent
Chi-Square for 8 x 8 table = 853.79
Where Chi-Square (0.05, 49) = when $n > 30$ $\sqrt{2X^2} - \sqrt{n-1}$ critical ratio = 26.35

c.r. p.05 =
c.r. p.01 =

*Expected frequencies, assuming, independence, corrected to nearest integer

TABLE 6.

CLASSIFICATION OF STUDENTS NOT USED IN DISCRIMINANT ANALYSIS

Actual Group	Assigned Group								Number of Hits		
	1	2	3	4	5	6	7	8	Total	Observed	Expected
1	10 (4)	13	1	11	3	10	2	0	50	10	4
2	2	8 (3)	2	7	2	8	2	1	32	8	3
3	1	5	48 (12)	4	2	3	15	4	82	48	12
4	4	4	0	14 (5)	1	13	1	1	38	14	5
5	8	3	12	5	16 (7)	8	14	16	82	16	7
6	4	7	2	12	1	14 (6)	2	0	42	14	6
7	7	10	13	5	11	8	23 (12)	5	82	23	12
8	2	1	0	0	5	2	4	36 (7)	50	36	7
Total	38	51	78	58	41	66	63	63	458	169	56

Efficiency of Classification = (169 x 100)/458 = 37.23 percent
Expected Chance Efficiency = (56 x 100)/458 = 12.22 percent
Chi-Square for 8x8 table = 293.15
Where Chi-Square (.05, 49) = when $n > 30\sqrt{2X^2} - \sqrt{n-1}$ = critical ratio = 24.21

where c.r. p.05 =
c.r. p.01 =

TABLE 7.

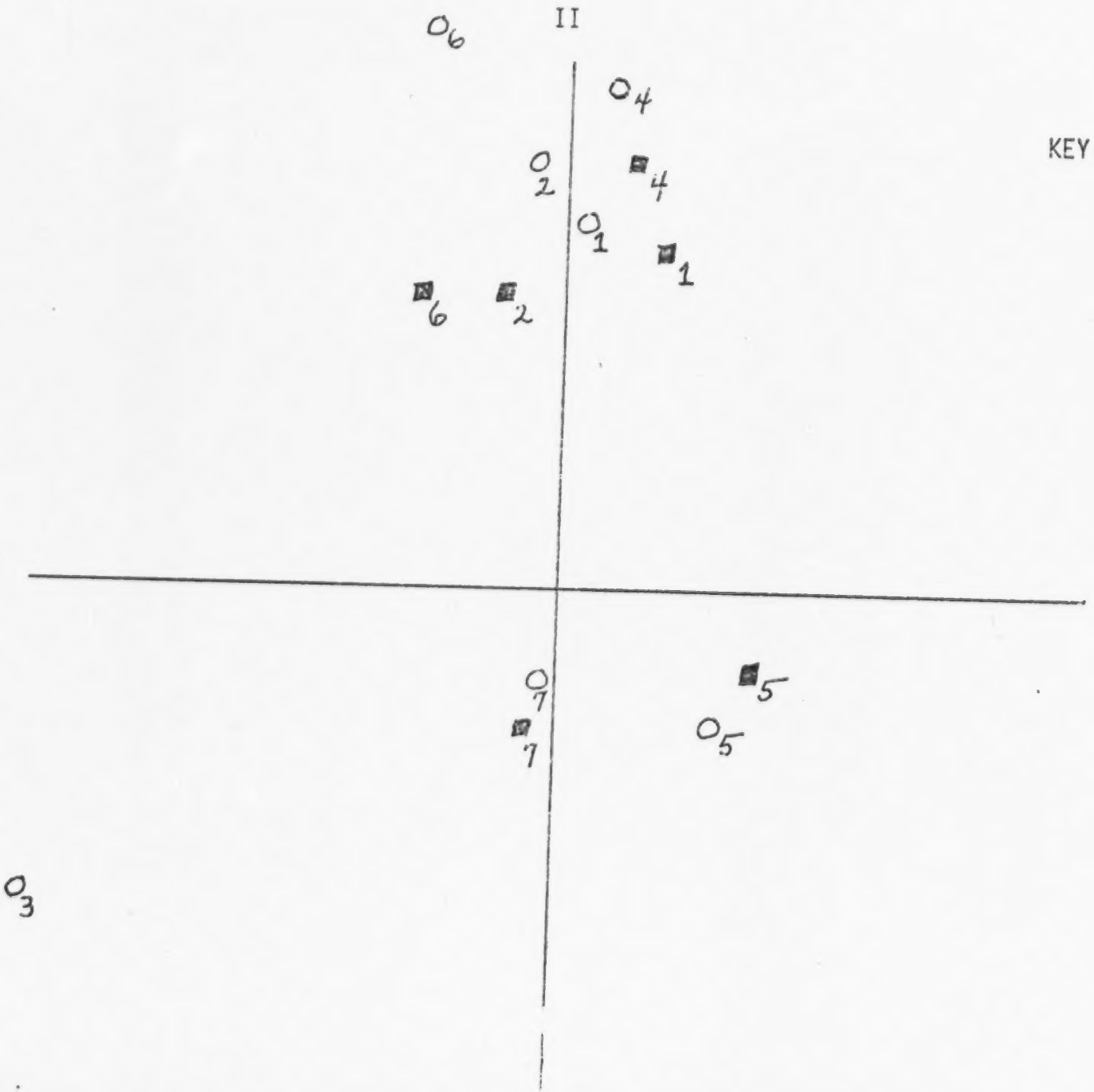
MEANS FOR THE EIGHT CRITERION GROUPS ON THE NINETEEN VARIABLES

Variable	O A E	O A $\bar{E}$	O $\bar{A}$	O_hA E	O_lA $\bar{E}$	$\bar{O}$ A E	$\bar{O}$ A $\bar{E}$	$\bar{O}$ $\bar{A}$ $\bar{E}$
1 General Information, I	176.750	159.328	122.909[b]	180.553	168.018	163.105	155.343	190.630[a]
3 Sociability	8.900[a]	8.500	8.319	8.395	7.241	8.221	7.681	7.260[b]
5 Impulsiveness	2.900	2.766[b]	3.253	2.592	2.934	3.291	3.012	3.410[a]
7 Calmness	6.710	6.609	5.578	6.724[a]	5.753	5.930	5.446[b]	6.460
11 Self confidence	6.940	7.063[a]	6.006	6.710	6.223	6.802[b]	6.633	7.090
13 Physical science	26.540	25.188	19.747[b]	26.461	25.602	25.581	24.928	27.730[a]
14 Biological science	31.660	30.047	25.741	33.303[a]	24.970	31.581	24.090	21.470[b]
16 Literary-linguistics	18.970	16.750[b]	20.680	19.184	18.423	19.128	18.036	20.360[a]
17 Social service	17.800	16.219[b]	22.151[a]	19.039	17.795	17.384	17.235	16.470
18 Artistic	19.260	17.625[b]	27.060[a]	18.447	18.958	18.105	18.000	20.210
20 Sports	29.750	29.828[a]	25.717[b]	29.026	28.307	26.070	27.970	28.140
23 Sales	17.840	18.250	18.879[a]	17.329	18.277	17.919	18.687	16.690[b]
24 Computation	18.320	16.391[b]	17.548	18.118	17.675	16.907	18.343[a]	18.340
25 Office work	12.380	11.547	19.398[a]	12.461	13.807	11.535[b]	12.837	12.650
29 Labor	9.090	8.922	11.951	8.960	11.036	8.267[b]	9.951	12.600[a]
30 Socio-economic index	106.750	105.156	101.313[b]	106.118	102.837	107.500[a]	103.675	101.740
31 I.Q. composite	221.760	203.063	153.404[b]	221.250	209.250	202.209	190.030	251.530[a]
34 Quantitative	159.270	137.719	89.096[b]	156.750	145.554	142.965	122.042	182.140[a]
36 Scientific aptitude	734.240	639.578	477.030[b]	729.855	686.662	651.291	606.078	823.820[a]

a) indicates the highest mean among groups.
b) indicates the lowest mean among groups.

Figure 1.

GROUPS PLOTTED IN A TWO DIMENSIONAL SPACE.



20.

Part II. PHARMACY.

Significant Variables. Thirteen significant variables were derived from the total 36 variables through successive F-tests in the Stepwise Program. Table 8 presents the F-values of these variables in descending order. It is observed that nine interest variables, three ability variables, and the socio-economic index were most influential in the differentiating process. Interest variables seemed to be the most effective discriminators while none of the temperament variables were effective discriminators.

TABLE 8.

F Values of 13 Significant Variables

Variable	
1. Biological Science Interest	17.48**
2. Physical Science Interest	10.52**
3. Technical Aptitude Ability Composite	6.82**
4. Social Service Interest	6.17**
5. Mechanical-Technical Interest	5.51**
6. General Academic Ability Composite	4.77**
7. General Info I Ability Composite	4.19**
8. Socio-economic Index	3.02**
9. Business Management Interest	2.32*
10. Artistic Interest	2.23*
11. Farming Interest	2.15*
12. Sales Interest	1.98*
13. Labor Interest	1.95*

where $F(.01,8,1000) = 2.53$
$F(.05,8,1000) = 1.95$

Comparability of Groups. Hartley's F-max test of homogeneity of dispersions showed that the Pharmacy groupings also cannot be considered

to be comparable. Table 10 presents the standard deviations for each criterion group on the thirteen significant variables. Single asterisks note that all the groups are heterogeneous on the basis of this test. Again, the large number of variables, groups and samples were believed to be instrumental.

Equality of Performance. The approximate F computed from the Wilk's Lambda indicates that the nine groups cannot be considered equal.

The computed F = 4.54 with d.f. = 288 and 8506.10

Where $F(.01,200,\infty) = 1.28$
$F(.05,200,\infty) = 1.19$

The aspect of equality, in regard to group differences, can also be viewed in observing group means. This will be presented later in this paper.

Discriminant Functions and Classification. After computing new linear, group specific polynomials (functions) based on the test variables, the Program approaches a cross-validation classification technique in prescribing an index or level of "best-fit" classification. Table 11 presents the classification of the original sample and Table 12 presents the classification of the cross-validation group. In both cases a significant Chi-Square is reported based on observed and expected classifications. It is interesting to note from a comparison of Table 13 that with a reduction from 36 to 13 variables, only a 3 percent drop in efficiency is observed.

While the 34.1 percent level of efficiency for the cross-validation groups might not appear to be very accurate, it should be remembered that only 11.1 percent efficiency could be expected through chance alone.

The program also classifies the probability of each case of each group into every group. This is particularly important in the counseling relationship since, as observed in Table 14, case 1 of group 3 is assigned to group 3; yet his chance of being classified or "fitting well" into group 9 is also high.

Identification of Canonical Functions. In viewing the 13 derived canonical functions based on the pharmacy groups, it is noted that the first two canonicals account for 86.4 percent of the cumulative proportion of the total dispersion variance (Table 15).

Group centroids appear in Table 9. Figure 2 presents the two dimensional Axis space developed by utilizing Canonical I and II as vectors in observing criterion group locations.

TABLE 9.

Canonical Variables Evaluated at Group Centroids

		C.F. I	C.F. II
1.	OPEP	.308	-.669
2.	OHEP	.611	-.320
3.	ONEP	-.745	-.641
4.	OPEH	.326	-.174
5.	OHEH	1.516	.435
6.	ONEH	.092	-.423
7.	OPEN	-.885	.053
8.	OHEN	.051	.119
9.	ONEN	-1.375	.434

The groups most widely separated on Axis I are ONEN and OHEH. Axis II best separates groups ONEP and OPEP from ONEN and OHEH.

In general, it can be stated that on Axis I, high positive contributions for OPEP, OHEP, OPEH, ONEH, and OHEN are exhibited on general information (ability), and biological sciences interest. High negative contribution for ONEP was shown on physical science interest and technical aptitude while OPEN indicated negative contribution on course related information (ability) and social service interest. In short, it seems that both Axis I and II best differentiate the criterion groups based on high and low contributors in general information (ability), biological sciences interests, mechanical-technical interests, physical sciences interests, and technical aptitude composite. The entered health groups are quite different on these variables than the entered non-health groups.

Figure 3 indicates the approximate graphical classification of fit between actual and assigned group members based on the canonical functions (group centroids).

General Group descriptions on the 13 significant variables can also be shown in viewing high and low mean scores. Table 16 presents the means for the 9 groups and indicates those which are high and low on each variable. An attempt to describe these differences resulted in the following summary:

Group 1 - Opted pharmacy, entered pharmacy.
The means for this group were high on General Information I, and General academic composite when compared to the other groups. Thus, these individuals had very high scores in the ability aspect of personality.

Group 2 - Opted health related, entered pharmacy.
The means for this group indicate individuals who are high in biological sciences and socio-economic index. (High scores for the interest variable.)

Group 3 - Opted non-health, entered pharmacy.
This group was high in physical sciences, business

management, and sales interest. It might be inferred that those who later found out about the possibilities of management within the role of pharmacy opportunities were convinced this may be an ideal field.

Group 4 - Opted pharmacy, entered health related. This group was not high on any mean, but was low on the farming interest. Apparently this group wished to stay in the city and be more "professionally" oriented. This might be a major cause of little attraction of health professional to rural areas.

Group 5 - Opted health related, entered health related. This group scored high on artistic interest and social service, and low on physical sciences, business management, sales interest, mechanical technical interest, labor interest, and technical aptitude composite.

Group 6 - Opted non-health, entered non-health. The means for this group were not high or low considering all the variables.

Group 7 - Opted pharmacy, entered non-health. The means for this group were low on General Information I, social service interest, and general academic composite. Apparently their early career choices were unrealistic since they never actualized them. These scores represent low ability students.

Group 8 - Opted health related, entered non-health. This group did not score low or high on any mean.

Group 9 - Opted non-health, entered non-health. This group scored high on mechanical technical interest, farming interest, and labor interest, and low on biological sciences, artistic interest, and the socio-economic index. Career realizations seem to be realistic and support general assumptions.

The overall findings seem to indicate that there is a describable difference among the groups on the significant variables as they relate to career development processing.

TABLE 10.

COMPARABILITY OF STANDARD DEVIATIONS FOR THE 9 CRITERION GROUPS BASED ON 13 SIGNIFICANT VARIABLES

No.	Variable Designation	1 OPEP	2 OHEP	3 ONEP	4 OPEH	5 OHEH	6 ONEH	7 OPEN	8 OHEN	9 ONEN	Significance
1	General Information I	22.376[b]	24.300	26.836	38.844[a]	29.200	34.815	37.903	37.739	38.236	*
13	Physical Sciences Int.	6.067	7.814	5.981[b]	7.901	8.181	8.307	7.880	8.610	8.920[a]	*
14	Biological Sciences Int.	7.391	8.520	7.357[b]	10.003	7.500	9.145	10.343[a]	8.780	9.224	*
17	Social Service Interest	7.050	6.640	5.604[b]	7.220	7.852[a]	7.451	6.990	7.687	7.004	*
18	Artistic Int.	8.025	9.455[a]	8.478	8.412	9.354	8.543	8.153	8.976	7.810[b]	*
22	Business Mgt. Interest	6.664	7.873[a]	5.196	6.083[b]	7.224	7.073	7.233	7.459	6.852	*
23	Sales Interest	7.962	7.605	7.473[b]	8.434	8.376	8.219	7.847	8.056	8.478[a]	*
26	Mech. Tech. Interest	7.119	7.924	6.096[b]	8.337	6.232	7.825	6.978	8.528[a]	7.669	*
28	Farming Int.	9.573	10.804[a]	9.382	8.896[b]	9.701	9.326	8.989	10.053	9.237	*
29	Labor Interest	6.310	5.457[b]	6.475	7.904[a]	5.464	5.727	5.993	6.617	5.907	*
30	Socio-Economic Index	8.151	8.172	7.909	10.308[a]	9.265	9.953	8.835	9.999	7.847	*
32	General Academic Composite	69.377[b]	81.478	81.007	121.225[a]	88.053	106.003	119.077	120.987	116.806	*
35	Tech. Aptitude Composite	12.877[b]	13.615	14.646	17.872	15.560	17.635	15.624	18.050	17.381	*

[a]Largest group variability per variable.

[b]Smallest group variability per variable.

Hartley's F-Max test of homogeneity of variance by variable is indicated as significant in last column (*).
F-Max (.05, 9, 8) = 1.00 (*).

TABLE 11.

CLASSIFICATION OF ACTUAL MEMBERS BASED ON FUNCTIONS FOR 13 SIGNIFICANT VARIABLES

Actual Group	Assigned Group 1	2	3	4	5	6	7	8	9	Total	Number of Hits Observed	Expected
1 OPEP	19(7)	14	9	12	10	10	3	10	3	90	19	7
2 OHEP	3	16(4)	4	5	7	3	1	5	1	45	16	4
3 ONEP	3	3	23(5)	2	0	5	9	5	8	58	23	5
4 OPEH	4	5	2	11(3)	6	1	5	2	3	39	11	3
5 OHEH	13	26	0	15	125(37)	9	1	10	2	201	125	37
6 ONEH	28	20	27	21	24	40(17)	8	15	18	201	40	17
7 OPEN	6	3	10	4	1	5	32(9)	8	24	93	32	9
8 OHEN	14	34	13	9	34	16	27	32(17)	22	201	32	17
9 ONEN	7	2	26	8	3	6	27	12	110(34)	201	110	34
Total	97	123	114	87	210	95	113	99	191	1129	408	133

Efficiency of classification = (408 x 100)/1129 = 37.1 per cent.
Expected chance alone efficiency = (133 x 100)/1129 = 11.7 per cent.
Chi-square for the 9 x 9 table = 288.5
Where Chi-square (.05, 64) = when $n \geq 30$
(.01, 64) (d.f.)

$$C.R. = \sqrt{2(X^2)} - \sqrt{2df. - 1}$$

$$z = 24.02 - 11.27$$
$$z = 12.75$$

C.R. .01 = ± 2.33
C.R. .05 = ± 1.64
(Ferguson, 1966)

TABLE 12.

CLASSIFICATION OF ASSIGNED MEMBERS NOT USED IN DISCRIMINANT ANALYSIS
BASED ON FUNCTIONS FOR 13 SIGNIFICANT VARIABLES

Actual Group	Assigned Group									Total	Number of Hits Observed	Number of Hits Expected
	1	2	3	4	5	6	7	8	9			
1 OPEP	6(3)	5	10	3	12	2	0	4	2	44	6	3
2 OHEP	1	9(2)	2	3	2	3	0	2	0	22	9	2
3 ONEP	3	1	12(3)	0	0	6	0	1	5	28	12	3
4 OPEH	2	3	1	1(1)	3	5	1	2	1	19	1	1
5 OHEH	5	14	0	10	64(21)	3	2	1	1	100	64	21
6 ONEH	14	13	17	5	21	14(7)	2	6	8	100	14	7
7 OPEN	2	1	5	3	0	2	21(4)	1	11	46	21	4
8 OHEN	8	17	8	10	17	3	14	15(6)	8	100	15	6
9 ONEN	3	0	24	3	3	4	9	4	50(15)	100	50	15
Total	44	63	79	38	122	42	49	36	86	559	192	62

Efficiency of classification = (192 x 100)/559 = 34.1 per cent.
Expected chance alone efficiency = (62 x 100)/559 = 11.1 per cent.
Chi-square for the 9 x 9 table = 316.7.

C.R. $z = 13.9$
C.R. .01 = ± 2.33
C.R. .05 = ± 1.64

TABLE 13.

CLASSIFICATION OF ACTUAL MEMBERS BASED ON FUNCTIONS FOR 36 ORIGINAL VARIABLES

Actual Group	Assigned Group 1	2	3	4	5	6	7	8	9	Total	Number of Hits Observed	Expected
1 OPEP	30(8)	11	11	9	8	11	4	4	2	90	30	8
2 OHEP	4	22(4)	1	5	5	1	1	3	3	45	22	4
3 ONEP	1	5	26(6)	5	0	3	6	4	8	58	26	6
4 OPEH	4	5	1	15(3)	6	2	3	1	2	39	15	3
5 OHEH	17	17	3	12	129(35)	9	1	11	2	201	129	35
6 ONEH	26	22	23	19	19	47(18)	12	11	22	201	47	18
7 OPEN	5	6	10	8	1	4	35(8)	3	21	93	35	8
8 OHEN	15	28	17	14	32	15	18	42(15)	20	201	42	15
9 ONEN	5	2	26	5	2	10	28	10	113(34)	201	113	34
Total	107	118	118	92	202	102	108	89	193	1129	459	131

* Efficiency of classification = (459 x 100)/1129 = 40.1 per cent.
Expected chance alone efficiency = (131 x 100)/1129 = 11.6 per cent.
Chi-square for the 9 x 9 table = 878.4.

C.R. .01 = $\pm$2.33
C.R. .05 = $\pm$1.64 z = 30.7

TABLE 14.

SAMPLE CLASSIFICATION PROBABILITIES PER CASE OBTAINED THROUGH STEPWISE ANALYSIS

Assigned From Group	Case	To Group	Group 1 OPEP D^2-P.P.	2 OHEP D^2-P.P.	3 ONEP D^2-P.P.	4 OPEH D^2-P.P.	5 OHEH D^2-P.P.	6 ONEH D^2-P.P.	7 OPEN D^2-P.P.	8 OHEN D^2-P.P.	9 ONEN D^2-P.P.
1	1	3	12.68(.07)	15.41(.01)	9.06(.43)	16.58(.01)	22.00(.00)	11.53(.12)	11.33(.14)	13.23(.05)	11.43(.13)
	2	1	12.33(.29)[a]	15.79(.05)	16.22(.04)	12.50(.27)[a]	15.18(.07)	14.97(.07)	14.22(.11)	15.46(.06)	14.03(.01)
	3	1	10.22(.36)	12.34(.12)	12.56(.11)	12.60(.11)	14.73(.03)	12.52(.11)	14.11(.05)	13.71(.06)	17.1 (.00)
2	1	2	3.43(.15)	2.19(.27)	5.91(.04)	3.93(.11)	3.84(.12)	4.04(.11)	6.84(.02)	3.51(.14)	9.91(.00)
	2	1	10.8 (.17)	10.98(.16)	12.45(.07)	13.21(.05)	11.20(.14)	11.23(.14)	13.01(.05)	10.95(.16)	15.1 (.02)
	3	5	16.34(.07)	16.35(.06)	21.08(.00)	13.40(.30)	12.65(.44)	16.31(.07)	21.89(.00)	18.26(.02)	21.2 (.00)
3	1	3	6.51(.11)	8.28(.04)	5.21(.21)[a]	7.53(.06)	12.86(.00)	7.27(.07)	5.44(.19)	7.03(.08)	5.27(.20)[a]
	2										
	3										

[a]Illustrates a high possibility of being classified into a group not specifically assigned to.

D^2 = Square of distance from each group (larger D^2 = further away from the probability of being classified in a particular group.

P.P.= Posterior probability for membership in each group.

TABLE 15.

COEFFICIENTS FOR CANONICAL VARIABLES (FUNCTIONS)

Orig. Variable (Significant)		I	II	III	IV	V	VI	VII	VIII	IX
1	General Information I	.01073	-.01148	-.02450	-.04844	.00578	.02668	-.00905	.03003	-.00757
13	Physical Sciences Int.	-.04573[a]	-.10662	-.02379	.01630	-.04459	-.02522	.01113	-.08096	.03603
14	Biological Sciences Int.	.06370[c]	.01555	.08465	.02790	.01009	.06077	-.03797	.00700	.03005
17	Social Service Int.	.04048	.04743	-.02660	.03356	.03815	-.05789	.10932	-.00340	-.05275
18	Artistic Int.	.00868	.00759	-.04041	.02889	-.06378	.03807	.03129	-.01752	-.00024
22	Business Mgt. Interest	-.00623[b]	-.03595[a]	.05129	-.06593	.07410	-.04907	-.03734	-.06771	-.012224
23	Sales Int.	-.01276	-.02999	.01778	-.05150	-.03812	.01150	.06127	.06864	.09246
26	Mechanical-Technical	-.04436	.07005[c]	-.02328	-.01377	.05632	.00147	.03373	.02723	.04169
28	Farming Int.	.00966	.00509	.01754	-.00196	-.06647	-.08304	-.03728	.04328	-.01518
29	Labor Int.	-.01450	.03172	-.02735	.06742	.07863	.07861	-.05326	-.03108	.06666
30	Socio-Econ. Index	.01818	-.00437[b]	.03672	.02157	.03180	-.03486	.01732	.02528	.02604
32	Gen. Academic Composite	.00395[d]	.00109[d]	-.00423	.00412	.00267	-.00711	-.00341	-.00490	.00596
35	Tech. Apt. Composite	-.03345	.00257	.04091	.09826	.00287	-.00949	.04178	.00120	-.04969
Cum. Proportion of Total Dispersion Variance		.72660	.86404	.92385	.96278	.98166	.99047	.99836	1.00002	1.00002
Canonical Correlation		.68294	.37666	.25909	.21151	.14904	.10242	.09693	.04477	.00050

[a]Highest negative variability.

[b]Lowest negative variability.

[c]Highest positive variability.

[d]Lowest positive variability.

TABLE 16.

EQUALITY IN REGARD TO HIGH AND LOW MEANS FOR THE 9 CRITERION GROUPS BASED ON 13 SIGNIFICANT VARIABLES

No.	Variable	OPEP	OHEP	ONEP	OPEH	OHEH	ONEH	OPEN	OHEN	ONEN	Grand Means[c]
1	General Information I	176.866[a]	175.666	171.775	164.769	161.527	172.606	144.354[b]	154.935	148.019	160.942
13	Physical Sciences Int.	26.700	25.200	28.724[a]	22.666	19.582[b]	26.323	23.139	23.597	22.736	23.719
14	Biological Sciences Int.	28.133	31.822[a]	24.620	26.794	30.930	27.174	22.720	28.174	18.228[b]	26.178
17	Social Service Interest	18.665	19.755	17.310	19.025	25.134[a]	18.203	16.483[b]	19.412	15.472	19.105
18	Artistic Int.	17.788	18.333	18.620	18.641	21.407[a]	19.901	16.666	18.378	16.373[b]	18.665
22	Business Mgt. Interest	20.744	19.044	21.637[a]	19.307	17.179[b]	18.293	21.204	19.268	19.203	19.102
23	Sales Interest	16.888	15.533	19.103[a]	16.256	14.203[b]	15.422	19.021	15.721	16.054	16.007
26	Mech. Tech. Interest	16.966	16.511	21.948	15.615	12.029[b]	17.587	20.946	18.303	24.039[a]	18.214
28	Farming Int.	18.133	17.377	18.568	15.051[b]	17.407	19.169	21.279	20.039	21.805[a]	19.326
29	Labor Interest	8.766	9.177	11.034	9.205	8.233[b]	9.049	11.666	10.646	14.308[a]	10.428
30	Socio-Economic Index	104.122	105.599[a]	101.706	100.051	103.079	101.751	98.376	101.786	96.766[b]	101.109
32	General Academic Composite	637.811[a]	624.244	593.551	591.102	616.183	616.363	505.193[b]	562.656	522.676	580.912
35	Tech. Aptitude Composite	65.088	66.444	69.068[a]	57.820	53.044[b]	65.422	56.688	59.681	60.820	60.596

[a]Highest group mean per variable.

[b]Lowest group mean per variable.

[c]Also includes withheld one-third group to be used in efficiency of classification index.

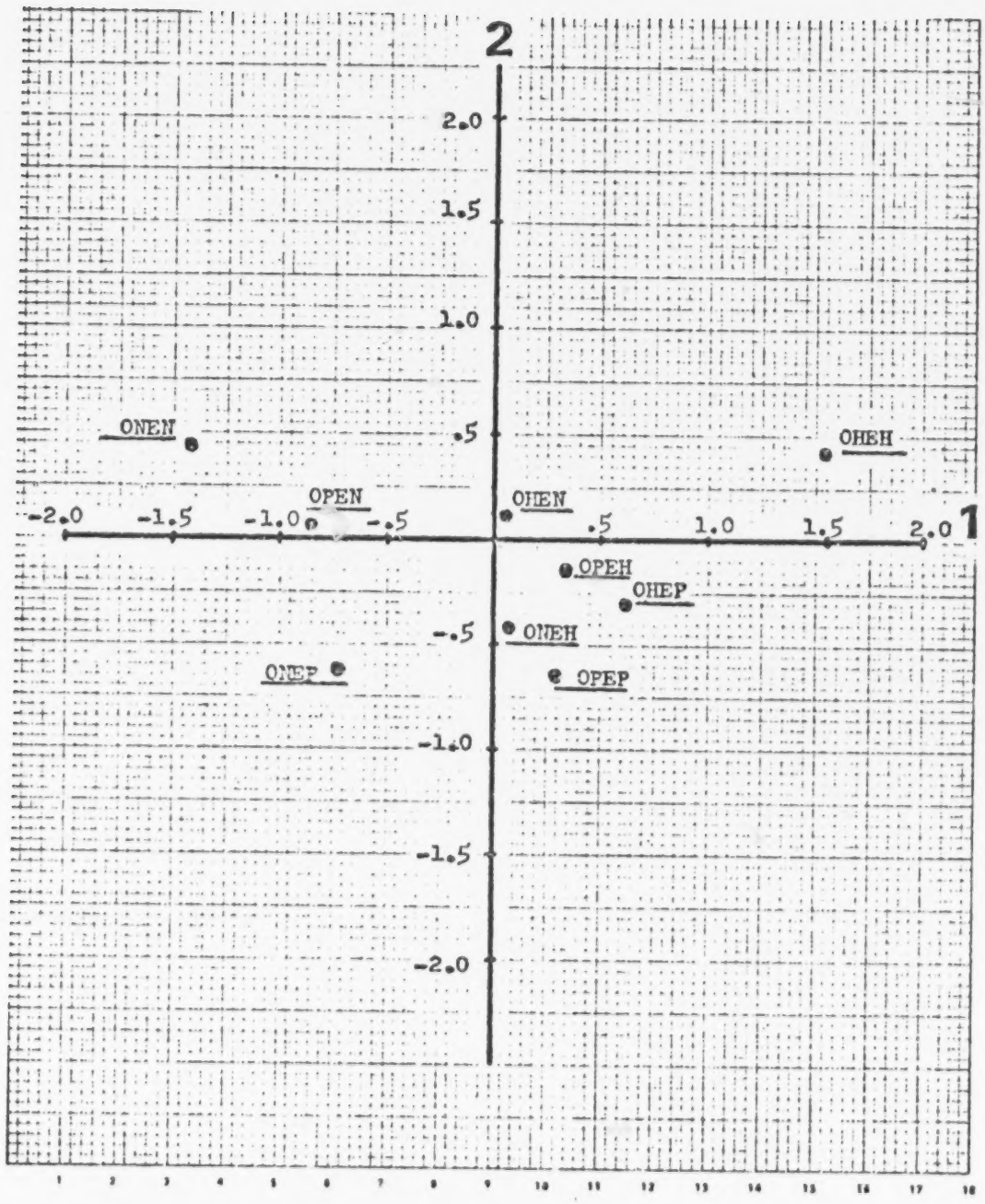


Fig. 2.--Group centroids in the test space with Canonical Functions I and II as vectors.

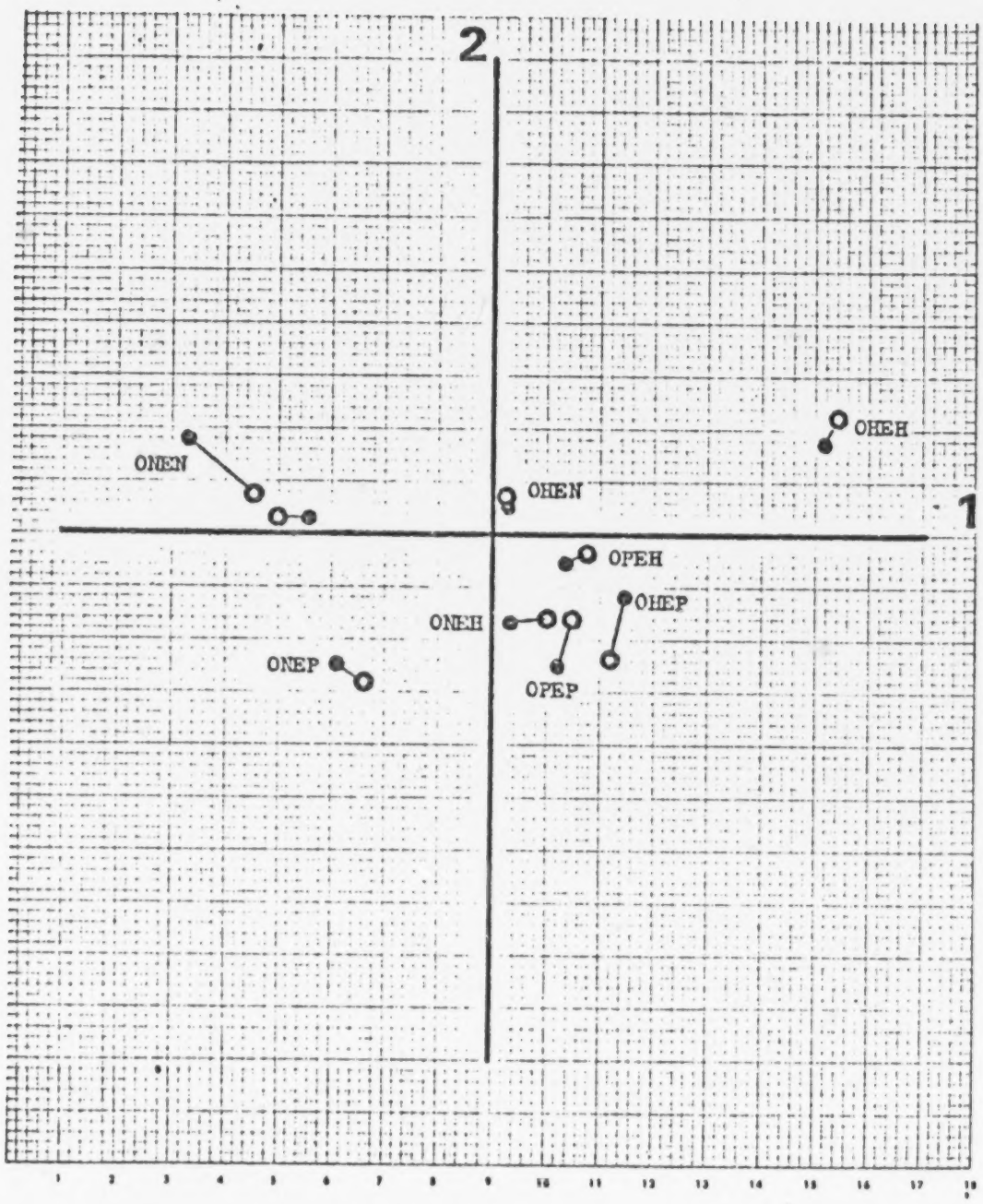


Fig. 3.--A comparison of original and withheld group centroids based on derived canonical functions as a measure of classification efficiency.

Part III. MEDICINE.

Representativeness of the Groups. The four groups of applicants to medical school (Groups I, II, IV, V) together comprise a 3 percent sample of all applicants for the years 1964-1968. Those who attended medical school (Groups I, IV) represent 93 of the 94 schools in operation at that time. The non-enrollees come from approximately 20 percent of the undergraduate colleges in the United States. Group III ($C\bar{A}E$) was distributed among the four high school classes at the time of testing in a proportion approximating the distribution of U.S. high school students in 1960 (Table 17).

TABLE 17.

PERCENTAGE DISTRIBUTION BY GRADE OF 1960 HIGH SCHOOL POPULATION AND STUDY GROUPS.

	U.S. High School Population (1960)	Study Groups CAE	$CA\bar{E}$	$C\bar{A}E$	$\bar{C}AE$	$\bar{C}A\bar{E}$
Grade 9	28.4%	16.0%	15.4%	29.1%	23.3%	24.8%
Grade 10	26.6%	22.3%	20.3%	27.4%	25.9%	24.8%
Grade 11	24.3%	26.4%	24.8%	23.7%	26.8%	26.5%
Grade 12	20.5%	34.7%	38.8%	18.0%	23.6%	22.8%

Comparability of Groups. For the physician study we entered forty-two personal variables, as described above in the Introduction. Of these, ten had an F value significant at the .01 level and were used in the analysis (see Table 23). The F_{max} test of homogeneity of dispersions indicates that the groups are not similarly dispersed on the ten significant variables. This is probably due to the large sample sizes, N = 191 for each group. Note in Table 18 that the F_{max} for seven of

the variables is relatively close to 1.00. The three variables for which F_{max} is greater are X1, I.Q. Composite, on which Group III ($C\overline{AE}$) had the greatest dispersion; X30, Biological Science Interest, and X46, health occupations interest, which probably have interacting items.

TABLE 18.

STANDARD DEVIATIONS FOR 5 GROUPS
ON TEN SIGNIFICANT PERSONAL VARIABLES

Variable	CAE	$CA\bar{E}$	$C\overline{AE}$	$\bar{C}AE$	$\bar{C}A\bar{E}$	F_{max}
X65 Aspirations	2.63[b]	2.96	3.29[a]	2.64	3.28	1.56*
X49 Career Choice	2.12	2.16[a]	2.10	1.87	1.81[b]	1.42*
X24 Tidiness	2.92	2.89	2.77[b]	2.90	3.01[a]	1.18*
X29 Phy. Sci. Int.	6.88[b]	6.93	7.81	7.17	8.37[a]	1.48*
X30 Bio. Sci. Int.	5.66	5.38[b]	8.07	8.45	9.81[a]	3.33*
X34 Artistic Int.	8.67	9.54	10.14[a]	8.29	7.95[b]	1.63*
X46 Health Occup	4.98[b]	5.53	7.87	8.17	9.10[a]	3.34*
X48 Prof. Occup.	5.62[b]	6.46	6.91[a]	6.11	6.50	1.51*
X 1 I.Q. Composite	23.33[b]	37.50	53.87[a]	36.61	44.21	5.33*
X 4 Quant.Composite	33.89[b]	39.66	39.83	42.07	43.51[a]	1.65*

F(df 190, 190; $p < .05$) = 1.00

*Significant
[a]Largest Variance
[b]Smallest Variance

Equality of Means. The group means for the ten personal traits are not equal. The approximate F computed from the Wilk's Lambda is significant at the .001 level.

Computed F = 22.25

F (df: 40, 3570; $p < .001$) = 2.23.

The F matrix in Table 19 shows that the means are also unequal for all pairs of groups.

TABLE 19

DIFFERENCE OF MEANS AMONG PAIRS OF GROUPS FOR SIGNIFICANT PERSONAL VARIABLES

	GROUP I	GROUP II	GROUP III	GROUP IV
GROUP II	4.75360*			
GROUP III	44.53642*	25.43576*		
GROUP IV	19.16809*	19.75098*	45.60883*	
GROUP V	27.82106*	22.97499*	25.66727*	7.35917*

*p <.001 (df: 10, 941)

Discriminating Functions. On the basis of group-specific discriminating functions derived from the ten significant personal variables, the cases in the study sample and in the replication sample were classified. The efficiency of classification for the study sample was 50.1 percent, and for the replication sample, 43.4 percent. The expected, chance alone efficiency was 20 percent for each sample. The chi-square for observed and expected classifications in both samples was significant at the .001 level. (See Tables 20 and 21.)

TABLE 20.

CLASSIFICATION OF STUDY SAMPLE BASED ON FUNCTIONS OF 10 SIGNIFICANT PERSONAL VARIABLES

	Classification Group						Correct Classifications	
Original Group	I	II	III	IV	V	Group N	Observed	Expected
I CAE	111 (45)	48	8	15	9	191	111	45
II $CA\overline{E}$	60	72 (38)	29	18	12	191	72	38
III $C\overline{AE}$	12	20	131 (41)	3	25	191	131	41
IV $\overline{C}AE$	29	24	10	88 (35)	40	191	88	35
V $\overline{CAE}$	14	24	28	49	76 (32)	191	76	32
					TOTAL	955	478	191

Efficiency of Classification = (478 x 100)/955 = 50.1%

Expected chance alone Efficiency = (191 x 100)/955 = 20.0%

Chi-square for 5 x 5 Table = 465.5

Where Chi-square (df 16, $p < .001$) = 39.25

TABLE 21

CLASSIFICATION OF REPLICATION SAMPLE BASED ON FUNCTIONS OF 10 SIGNIFICANT PERSONAL VARIABLES

	Classification Group						Correct Classifications	
Original Group	I	II	III	IV	V	Group N	Observed	Expected
A CAE	50(24)	24	7	13	1	95	50	24
B $CA\overline{E}$	32	32(20)	16	12	3	95	32	20
C $C\overline{AE}$	8	15	62(20)	0	10	95	62	20
D $\overline{C}AE$	20	14	8	32(18)	21	95	32	18
E $\overline{CAE}$	11	14	8	32	30(13)	95	30	13
					TOTAL	475	206	95

Efficiency of Classification = (206 x 100)/475 = 43.4%

Expected chance alone efficiency = (95 x 100)/475 = 20.0%

Chi-square for 5 x 5 Table = 264.59

Where chi-square (df 16, $p < .001$) = 39.25

Canonical Functions. The next step in the Discriminant Analysis was the computation of canonical variables. In this phase of the physician study canonical variable 1 (a linear compound of the ten significant personal traits) accounts for 56 percent of the variation between groups, and canonical variable 2 accounts for another 40 percent of variation. Table 22 gives the centroids for each group on canonical variables 1 and 2. These are the coordinates plotted in Figures 4 and 5.

TABLE 22.

GROUP MEANS FOR CANONICAL VARIABLES
(PERSONAL TRAITS)

Group	Canonical Variables I	II	Group	Canonical Variables I	II
I (CAE)	.71	-.67	A (CAE)	.73	-.71
II (CAE)	.16	-.66	B (CAE)	.20	-.67
III (CAE)	-1.39	-.18	C (CAE)	-1.30	-.27
IV (CAE)	.62	.69	D (CAE)	.49	.49
V (CAE)	-.11	.82	E (CAE)	.19	.82

Note that Group III (non applicants) is farther on Canon 1 from Groups I and IV (medical students) than from Groups II and V (those not admitted to medical school). On Canon 2, Group I is closer to Group II than to Group IV; Group V is closer to Group IV than to Group II. Thus, those who chose medicine in high school, whether they enter medical school or not, have similar personal traits. Those who chose medicine later, whether or not they enrolled, have similar traits. The groups seem to be separated on personal traits according to when a medical career was first chosen, rather than according to whether or not they were admitted to medical school. Tables 24 and 25 show the contribution of the ten personal variables to the discriminating power of canonical variables 1 and 2. We can then describe the different traits of each group.

Group I (CAE) - Those who chose medicine early, applied to and entered medical school, scored high on the quantitative composite and fairly high on the I.Q. composite. This group scored highest on the aspirations scale (money expect to earn, money satisfied to earn, education expected). They evinced a negative interest in other health occupations, but a positive interest in other professions. This group showed a negative interest in the biological sciences.

Group II ($CA\bar{E}$) - Those who chose medicine early, applied to but did not enter medical school, scored much lower on the quantitative composite. This group scored a little lower on the aspirations scale than did Group I. They, too, evinced a negative interest in other health occupations, but a positive interest in other professions. This group evinced an even stronger negative interest in biological sciences than did Group I.

Group III ($C\bar{A}\bar{E}$) - Those who chose medicine early but did not apply to medical school scored quite low on both the quantitative and I. Q. composites. Their aspirations were about the same as Group II. They evinced a slightly negative interest in both other health occupations and in other professions. They showed a strong negative interest in the physical sciences.

Group IV ($\bar{C}AE$) - Those who chose medicine later, applied to and entered medical school scored relatively high on the quantitative and I.Q. composites. They evinced a positive interest in both other health occupations and other professions. This group showed a positive interest in both the biological and physical sciences.

Group V ($\bar{C}A\bar{E}$) - Those who chose medicine later, applied to but did not enter medical school did not score high on either the quantitative or I.Q. composites. They evinced a positive interest in other health occupations, but a negative interest in other professions. Their aspirations were about equal to Groups II and III. This group showed the strongest positive interest in the biological sciences.

CONCLUSIONS.

In the studies just reported, we have looked at personal traits in an attempt to 1) differentiate stable from non-stable career choice; 2) compare groups who have made early career decisions with those who decided later; and 3) learn what traits distinguish applicants admitted to professional schools from applicants not admitted. The data suggest certain considerations for career counselors and for admissions personnel.

Do counselors (and admissions committees, for that matter,) reenforce the scientist stereotype of the health professions? Students with high I.Q.'s and who display superior quantitative aptitude are expected to choose elite careers, such as medicine.

Should the focus of early counseling be on career decision? Would it not be more useful for the student to provide him an atmosphere

where all options are open to him, where he is encouraged to explore beyond the ability requirements of a few careers, to the kinds of activities associated with many careers. With this knowledge he may better assess his own personal traits in reference to specific careers.

Our data indicate that those applicants not admitted to professional schools do not differ significantly on general academic aptitude from those admitted. Selection committees could influence the supply of health personnel who are more likely to choose jobs, within their professions, that offer the opportunity to respond to the specific needs of society, for example, general practice in the rural areas and the inner cities.

It is part of the design of the physician study to follow the two groups of students into medical practice. Will the differences in interest and temperament traits be related to the type and location of practice? Another phase of the study will look more closely at the applicants not admitted. Have they followed other health careers, for example, health administration; or other science careers, such as biological research; or other service careers, such as teaching.

In summary, there are two sorting points in the career development process. The first is the individual's self assessment of abilities and aptitudes in relation to his perception of the occupations open to him. Counselors, as well as parents and family, have input into both the self-evaluation and the career model. The second sorting occurs when professional schools select from the pool of applicants, those they consider will best fit the career model as perceived by the profession.

TABLE 23.

F Values for 40 Personal Traits

Var #	Title	F-Values
X4	Quant. Comp (C004)	111.1819***
X46	Health Occup. Int.	43.1022***
X29	Phys -Sci, Engr. Math Int.	16.0802***
X30	Bio-Sci, Med. Int.	15.3372***
X65	Aspirations	12.4888***
X49	Career Choice Scale	6.8497***
X34	Artistic Int.	5.3841***
X48	Profess. Occup. Int.	6.8765***
X1	I.Q. Composite (C001)	4.3081**
X24	Tidiness	3.6190**
X36	Sports Int.	3.2807*
X21	Impulsiveness	3.1504*
X26	Leadership	2.7615*
X44	Farming Int.	2.2120
X43	Skilled Trades Int.	2.1802
X41	Office Work Int.	3.0624*
X35	Musical Int.	1.8861
X19	Sociability	1.8102
X23	Calmness	1.4832
X12	Info I (course-related)	1.5764
X45	Labor Int.	1.4099
X31	Public Services Int.	1.3968
X27	Self confidence	1.3122
X39	Sales Int.	1.0395
X38	Bus. Mgt., Int.	0.9349
X13	Info II (non course-related)	0.8101
X37	Hunting-Fishing Int.	0.6212
X40	Computation Int.	0.6239
X60a	Importance of People	0.5879
X50a	Importance of Income	0.6496
X22	Vigor	0.5389
X28	Mature Personality	0.5887
X42	Mech.-Tech. Int.	0.4917
X5	Tech. Comp. (C005)	0.6026
X47	Health Related Occup. Int.	0.4985
X25	Culture	0.4428
X3	Verbal Comp (C003)	0.3827
X20	Social Sensitivity	0.3338
X32	Lit-Linguistics	0.2620
X33	Social Service	0.2701

Variables X2, General Academic Aptitude, and X6, Science Composite, did not pass the tolerance test (.0001).

***Significant at .001 (df: 4,911)
**Significant at .01
*Significant at .05

TABLE 24.

DISCRIMINATING POWER OF PERSONAL VARIABLES IN CANON 1.

Original Variable		Group I	Group II	Group III	Group IV	Group V
X65	Aspirations	+.03	+.02	-.02	-.01	-.02
X49	Career Choice	+.001	+.001	+.001	-.001	-.002
X24	Tidiness	+.02	+.02	-.04	+.02	-.02
X29	Phy. Sci. Int.	+.01	+.02	-.08	+.06	-.01
X30	Bio. Sci. Int.	-.06	-.08	+.01	+.04	+.10
X34	Artistic Int.	+.02	+.02	-.06	-.02	+.04
X46	Health Occup. Int.	-.11	-.13	-.05	+.13	+.16
X48	Professions Int.	+.06	+.05	-.08	+.04	-.07
X 1	I.Q. Composite	+.26	+.07	-.40	+.15	-.08
X 4	Quant. Composite	+.64	+.20	-.94	+.33	-.23

TABLE 25.

DISCRIMINATING POWER OF PERSONAL VARIABLES IN CANON 2.

Original Variable		Group I	Group II	Group III	Group IV	Group V
X65	Aspirations	+.22	+.12	+.12	+.09	+.13
X49	Career Choice	-.02	-.06	-.06	+.04	+.10
X24	Tidiness	+.01	+.01	-.03	+.01	-.01
X29	Phy. Sci. Int.	+.05	+.07	-.29	+.21	-.04
X30	Bio. Sci. Int.	-.28	-.39	+.04	+.19	+.44
X34	Artistic Int.	+.0002	+.0002	-.0006	-.0002	+.0004
X46	Health Occup. Int.	-.14	-.17	-.06	+.17	+.20
X48	Professions Int.	+.04	+.03	-.05	+.02	-.04
X 1	I.Q. Composite	+.10	+.03	-.16	+.06	-.03
X 4	Quant. Composite	+.32	+.10	-.47	+.17	+.12

Figure 4.

PLOT OF 5 GROUPS: SIGNIFICANT PERSONAL VARIABLES

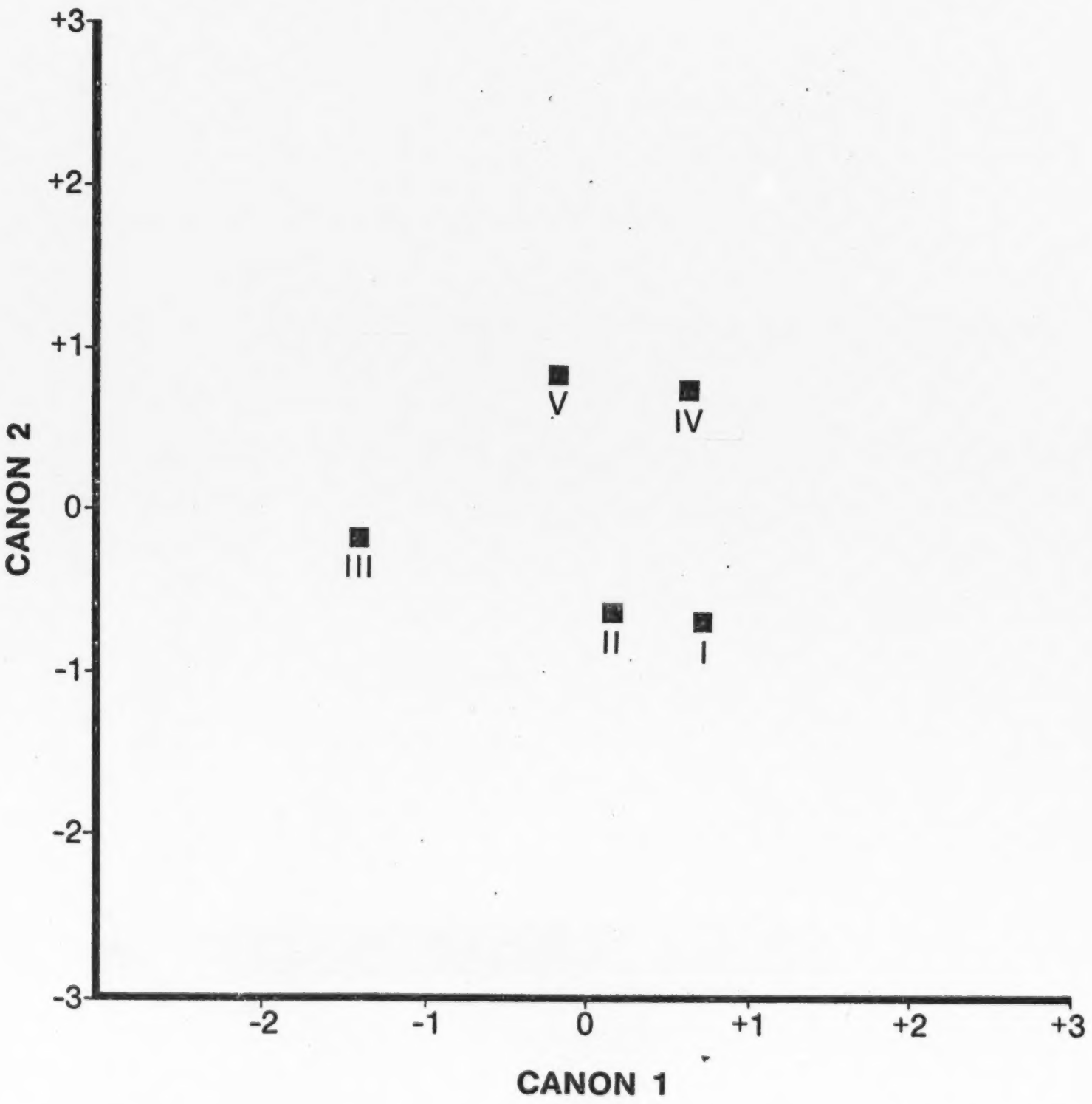
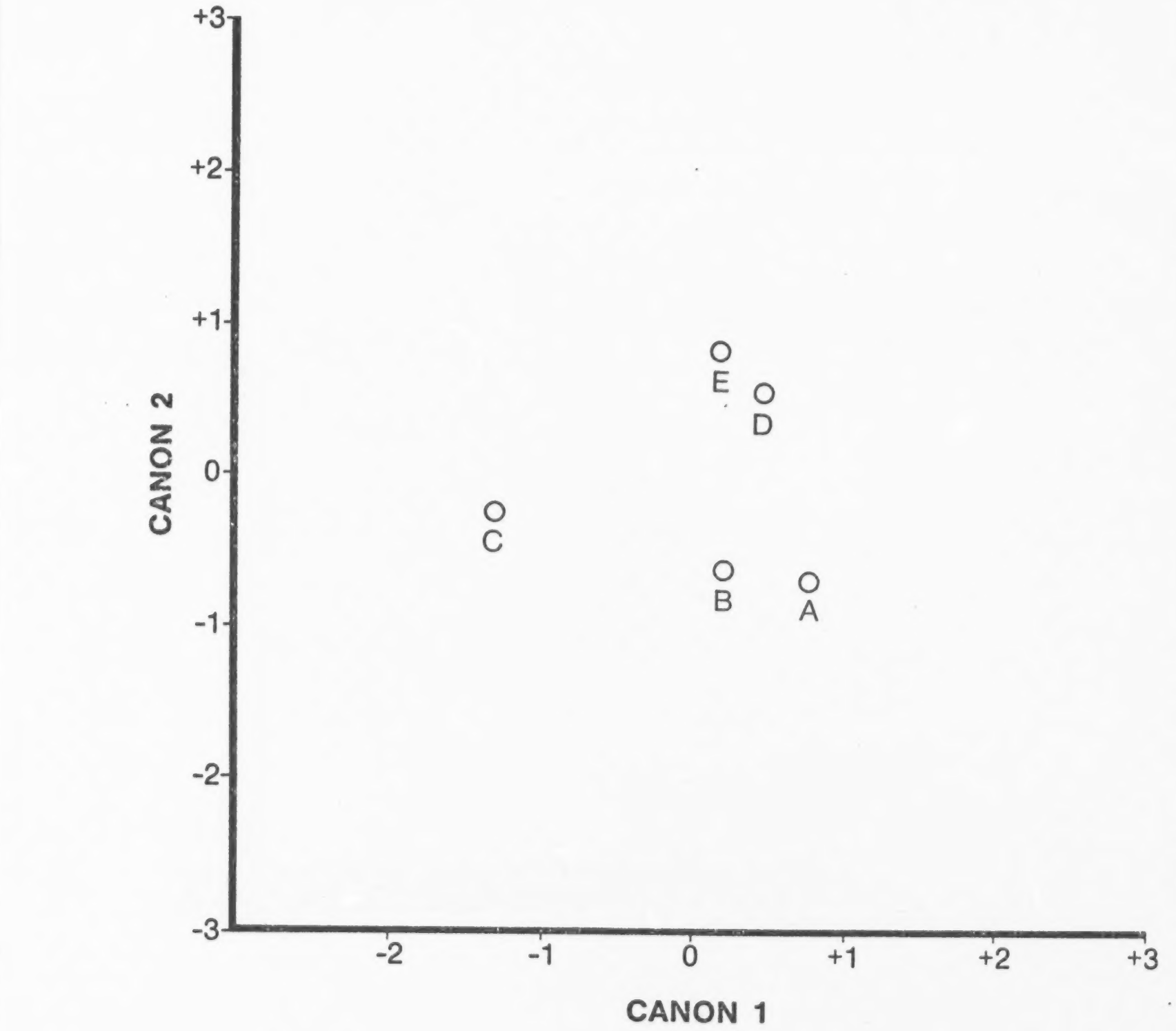


Figure 5.


PLOT OF 5 GROUPS: SIGNIFICANT PERSONAL VARIABLES
+3
+2
+1
0
-1
-2
-3
CANON 2
E
D
C
B
A
-2
-1
0
+1
+2
+3
CANON 1